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# 50 Years of Research Confirms Serious Health Risks Linked to This Food Additive

*Potassium bromate, a powerful oxidizing agent commonly used as a food additive in baked goods, including breads, pastries, bagels and crusts, has been linked to various cancers, along with thyroid disease, kidney damage, gut irritation and reproductive abnormalities.*

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KBrO3
POTASSIUM BROMATE

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**By Mikaela Conley**

Potassium bromate is a powerful oxidizing agent commonly used as a food additive in baked goods, including breads, pastries, bagels and crusts.

It has been linked to various cancers, along with thyroid disease, kidney damage, gut irritation and reproductive abnormalities.

In 1999, the International Agency for Research on Cancer (IARC), categorized potassium bromate as "possibly carcinogenic to humans."

It has been banned as a food additive in Europe since 1990, in Canada since 1994, and in India since 2016. Other countries that have banned potassium bromate include Nigeria, Brazil, Argentina, South Korea, Peru, China and Sri Lanka.

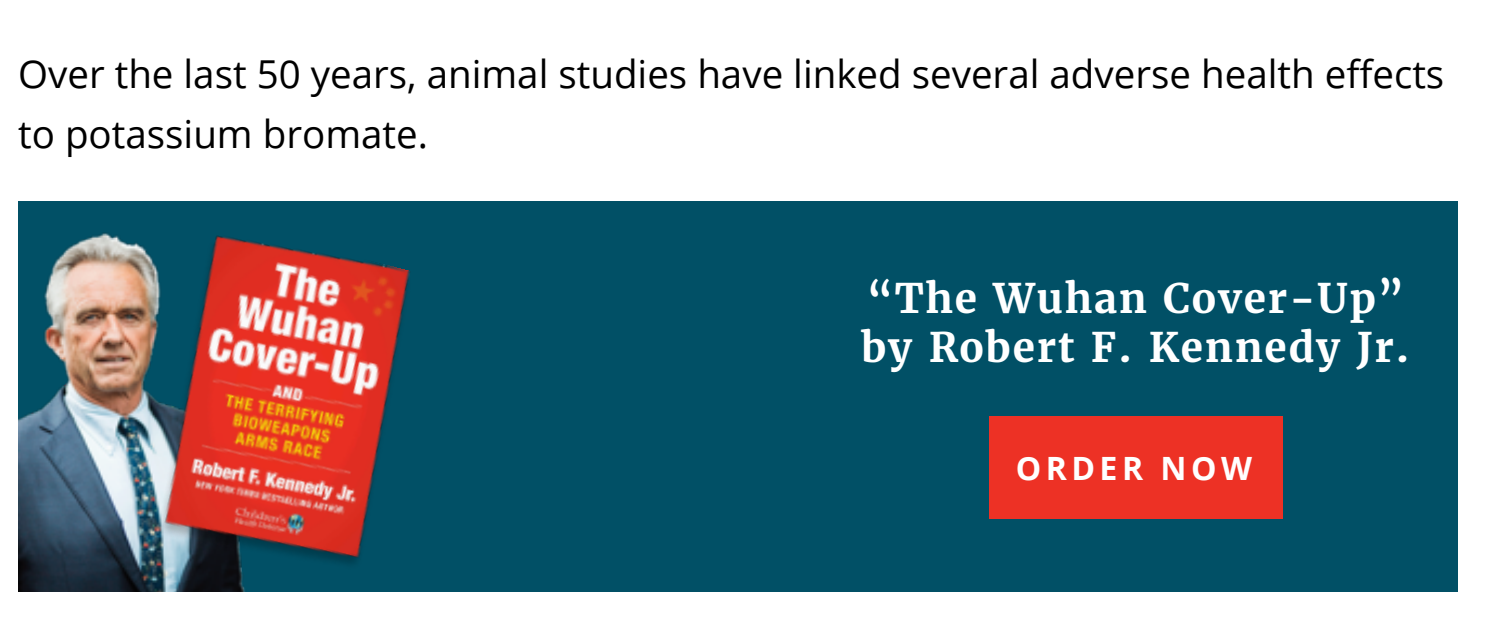
### California bans potassium bromate

In October, California Gov. Gavin Newsom signed a bill into law banning the use of potassium bromate, along with three other common food additives (brominated vegetable oil, propylparaben and red dye No. 3).

The California Food Safety Act takes effect in 2027 when it will be outlawed to sell, distribute and manufacture the additives in the state. It is the first time that a U.S. state has prohibited food additives that are deemed safe by the U.S. Food and Drug Administration (FDA).

### Medical research suggests health risks

Over the last 50 years, animal studies have linked several adverse health effects to potassium bromate.



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### Renal cancer, toxicity and damage

Several major studies and reviews have linked the consumption of potassium bromate to damage and cancer of the kidneys.

The IARC, in its 1999 evaluation of potassium bromate, wrote:

> "In rats, [potassium bromate] produced renal tubular tumours (adenomas and carcinomas) and thyroid follicular tumours in animals of each sex and peritoneal mesotheliomas in males. In mice, it produced a low incidence of renal tubular tumours in males.
>
> "In hamsters, the incidence of renal tubular tumours was marginally increased. Potassium bromate did not increase tumour incidence in bioassays in newborn rats and mice, but it enhanced the induction of kidney tumours by N-nitrosoethylhydroxyethylamine in several experiments."

In a review published in 1990 in the journal Environmental Health Perspectives, Japanese scientists examined the links between potassium bromate and renal cell tumors, mesotheliomas of the peritoneum, along with follicular cell tumors of the thyroid.

They wrote that experiments demonstrated that the food additive "is a complete carcinogen, possessing both initiating and promoting activities for rat renal tumorigenesis."

Researchers also noted the "strong potential" of potassium bromate to trigger chromosome aberrations, along with its "inhibitory effects on inducing lipid peroxidation in the rat kidney."

The researchers concluded that potassium bromate "is a genotoxic carcinogen inducing renal cell tumors, mesotheliomas, and thyroid follicular cell tumors in rats. … [It is a] complete carcinogen having both initiating and promoting activities for the development of renal cell tumors."

In a 1986 study published in the Journal of the National Cancer Institute, Japanese researchers separated rats into several groups and gave them various doses of potassium bromate for 104 weeks.

Afterward, the animals were autopsied and examined histopathologically. The researchers found that the animals given the highest dose had the lowest survival time.

The combined incidences of renal adenocarcinomas and adenomas were "significantly increased" in rats treated in the groups given the three highest doses of the additive.

They also found that in the group treated with the highest dose, "the combined incidences for follicular adenocarcinomas and adenomas of the thyroid and for mesotheliomas of the peritoneum were shown to be significantly increased."

In a 1983 study published in the Journal of the National Cancer Institute, researchers gave groups of rats different concentrations of potassium bromate in drinking water and examined survival rates.

The group given the highest concentration had the shortest survival time. Researchers observed high rates of renal cell tumors in the groups given the highest doses of potassium bromate, along with mesotheliomas of the peritoneum in males given the highest dose.

The tumor incidences in the test groups were "significantly" higher than those in the control group.

The researchers concluded: "When orally administered under the conditions of this experiment, potassium bromate was carcinogenic to F344 rats."

In a 2018 study published in the Saudi Journal of Biological Sciences, researchers examined the effects of potassium bromate by dividing mice into three groups, a control group, a group given a low dose of potassium bromate, and one given a high dose.

Animals in both the low- and high-dose groups experienced a decrease in white blood cells, red blood cells and platelets.

They also noted altered lipid profiles, along with impaired renal and hepatic history, and decreased glutathione levels in both renal and hepatic tissue in treated mice.

The authors concluded: "These results show that potassium bromate has serious damaging effects and therefore, its use should be avoided."

### Testicular and peritoneal mesotheliomas

Researchers from North Carolina State University examined the effects of potassium bromate administered in various concentrations in drinking water to 344 rats.

In the study, published in 2000 in the journal Toxicologic Pathology, the scientists found that all the animals showed mesotheliomas of the peritoneum and in the membranes of the scrotum.

The researchers noted:

> "The mesorchium appears to be the major mesothelial target site for potassium bromate-mediated carcinogenesis.
>
> "The frequency of occurrence of mesotheliomas by location was tunica vaginalis testis (25%), mesosplenium (20%), mesentery (10%), mesojejunum/mesocolon (8%), bladder (6.5%), mesogastrium (13%), liver serosa (5%), and kidney, small intestine, and rectum (1% each)."

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### Oxidative stress

Oxidative stress refers to an imbalance in the production of free radicals and antioxidant defenses (which neutralize free radicals) in the body. Numerous animal studies show that the consumption of potassium bromate can induce such an imbalance in the body.

In a study published in the journal Toxicology in 2006, researchers examined the contribution of oxidative stress in potassium bromate-induced cancers. The scientists fed rats drinking water with multiple concentrations of potassium bromate for 2 to 100 weeks and then analyzed gene expression on kidney, thyroid and mesothelial cell RNA.

They found "families of mRNA transcripts differentially expressed with respect to bromate treatment included multiple cancer, cell death, ion transport and oxidative stress genes."

The researchers concluded:

> "These results suggest that carcinogenic doses of potassium bromate require attainment of a threshold at which oxidation of tissues occurs and that gene expression profiles may be predictive of these physiological changes in renal homeostasis."

In a 2019 study published in the journal Toxicology and Industrial Health, researchers investigated the effects of perinatal potassium bromate exposure "on the development of sensorimotor reflexes and redox status, and on the histological architecture of the brain, liver, and kidney of newborn mice."

They separated pregnant mice into two groups, one of which was given, from 5 days gestation to 21 days postnatal, water with dissolved potassium bromate. The other was the control group and given uncontaminated drinking water.

The researchers wrote:

> "$KBrO_3$ [potassium bromate] induced a decrease in the postnatal body weight in the newborn mice. $KBrO_3$-exposed newborn mice showed poor performance and delayed development of the sensorimotor reflexes.
>
> "Histological changes, increased lipid peroxidation, and altered antioxidants were reported in the cerebrum, cerebellum, medulla oblongata, liver, and kidney of the $KBrO_3$-exposed newborn mice."

The scientists concluded:

> "These findings demonstrated that perinatal exposure to bromate induced oxidative stress, histological and behavioral alterations, and was a potential teratogen in newborn mice."

In 2022, Saudi Arabian researchers published a study in Mutation Research/Genetic Toxicology and Environmental Mutagenesis, which sought to examine the oxidative stress, genotoxicity, and apoptosis induced by potassium bromate.

They did this by administering various doses of the food additive to mice over multiple periods (24, 48 and 72 hours).

They found that potassium bromate "significantly induces oxidative damage by increasing the levels of reactive oxygen species and lipid peroxidase and depleted the levels of catalase, superoxide dismutase and glutathione enzymes in the serum and liver."

The scientists also observed "a significant increase of chromosomal aberrations in bone marrow cells and an elevated incidence of micronuclei in the peripheral blood."

They concluded: "Consumption of potassium bromate should be discouraged and used with proper precautions."

### Genotoxicity/cytotoxicity

Genotoxicity refers to a chemical's potential to cause DNA damage, which can, in turn, lead to cancer. Cytotoxicity is a general term that refers to the ability to cause damage to cells.

In a 2007 study published in the journal Mutation Research/Genetic Toxicology and Environmental Mutagenesis, researchers sought to examine in vitro any potentially genotoxic effects of potassium bromate on human peripheral blood lymphocytes.

Over 24 and 48 hours, cells were treated with varying doses of the oxidizing agents. Among other findings, potassium bromate "statistically significantly induced" chromosomal aberrations after both treatment periods.

The researchers concluded: "These in vitro results provide important evidence about genotoxicity of potassium bromate on a human cell culture system."

In a 2018 study published in the journal Mutation Research/Genetic Toxicology and Environmental Mutagenesis, researchers examined the oxidative stress induced by potassium bromate, and how potassium bromate affects ataxia telangiectasia mutated (ATM) proteins, which are involved in DNA damage response.

They found that "ATM-defective LCLs [lymphoblastoid cell lines] are hypersensitive to potassium bromate in terms of chromosomal damage."

In a 2020 study published in the Journal of Food Biochemistry, researchers investigated the effects of potassium bromate on the stomach epithelial in an ulcerated stomach.

The researchers wrote:

> "Potassium bromate exacerbated gastric ulcers, increased malonaldehyde levels, catalase, and sodium pump activities, but reduced nitric oxide levels.
>
> "Potassium bromate further increased mast cell count in the muscularis mucosa, while inducing chronic inflammation and moderate angiogenesis in the gastric mucosa. Our results delineate potassium bromate-induced gastric epithelial cytotoxicity that is ameliorated by protocatechuic acid."

In a 1999 study published in the journal Mutation Research/Genetic Toxicology and Environmental Mutagenesis, scientists compared the genotoxic properties of potassium bromate and potassium superoxide.

They wrote:

> "Both substances clearly induced cytotoxicity, chromosome aberrations and increased DNA migration in the alkaline comet assay."

They added:

> "We detected oxidative DNA base damage only after potassium bromate treatment. HPLC [high-performance liquid chromatography] analysis also revealed significantly increased levels of 8-oxodeoxyguanosine after potassium bromate treatment but not after potassium superoxide treatment."

Potassium bromate also "clearly induced gene mutations at the HPRT [hypoxanthine phosphoribosyltransferase] locus."

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### Hearing loss and inner ear damage

"For years, it has been known that ingested potassium bromate and sodium bromate can induce hearing loss," Dr. Kathleen Campbell wrote in a 2006 report published in Toxicology.

She went on to note that, after ingesting high doses of bromate, hearing loss has been observed to occur quickly and severely.

Campbell wrote of the intricacies of the hearing loss:

> "Based on animal studies, in the cochlea, bromate damages the stria vascularis, Reissner's membrane, inner and outer hair cells, Claudius cells and inner sulcus cells. Physiologically, bromate reduces the endocochlear potential, cochlear microphonics, and electrophysiologic auditory thresholds."

### Neurobehavioral changes

In a 2016 study published in the journal Behavioral and Brain Functions, researchers investigated the effects of potassium bromate on the brain function of albino mice by grouping them into three groups: a control group, a group that was administered a low dose of the oxidizing agent and a third group that was administered a high dose.

While researchers observed body weight changes in the high-dose group, they also observed neurobehavioral changes and a reduction of neurotransmitter levels in both the low-dose and high-dose groups. Glutathione levels also decreased in both groups.

The researchers concluded: "These results show that potassium bromate has serious damaging effects on the central nervous system and therefore, its use should be avoided."

### Disrupts mitochondrial distribution

In a 2018 study published in the journal Reproductive Medicine and Biology, researchers examined whether potassium bromate causes harmful effects on nuclear maturation and mitochondrial cluster formation in oocytes in mice.

The researchers cultured the oocytes with various amounts of potassium bromate. Researchers observed, "significantly decreased rates of metaphase II (MII) oocytes … with 750 μM and 1000 μM of potassium bromate, while a significant increase in abnormal mitochondrial clusters was induced at 500 μM."

### What exactly is potassium bromate?

Potassium bromate is a chemical compound composed of the elements potassium (K), bromine (Br) and oxygen (O). It is a white crystalline powder that is used as an oxidizing agent, lab reagent, and food additive.

As a food additive, it is known as E924 and is used to strengthen dough, improve texture, and enhance the volume and appearance of baked goods.

It is one of the most inexpensive flour improvers in the baking industry, and, when used properly in food, potassium bromate reduces to the nontoxic byproduct bromide in the baking process.

Problems arise if baking conditions are incorrect (for example, the item is baked at a low temperature or too much potassium bromate is added) and potassium bromate residues persist in the final baking product.

In countries where it is still permitted, regulations often specify maximum residual limits for potassium bromate in finished baked goods.

These limits are intended to ensure that the level of residual potassium bromate is within acceptable safety margins.

The FDA currently permits 0.0075 parts potassium bromate for every 100 parts by weight of flour used in food preparation and products.

As a food additive, it appears on ingredient lists as "potassium bromate" or "bromated flour."

### Grandfathered into 'GRAS'

Potassium bromate was first patented for use in baking in 1914 and went on the market soon after. At the time, there were no regulatory agencies in the U.S. to oversee the safety of food additives in consumer goods.

When the Food Additive Amendments of 1958 was enacted out of concern for the health risks of chemicals in the food supply, this required new additives to be determined as "generally recognized as safe," or GRAS, before going to market.

But, if food additives like potassium bromate were already on the market, they were not required to be reassessed and simply grandfathered into the GRAS categorization.

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*Mikaela Conley is a science journalist at U.S. Right to Know.*

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Best Newest Oldest

**Pat**
17 days ago

Thankfully, I make all of our breads from scratch, so as long as they haven't added this to unbleached flour, we're good. That said, the FDA approves many additives that are extremely harmful to us; they certainly do not have our best interests at heart.

12 0 Reply • Share ›

**BChristine** → Pat
17 days ago

Absolutely right. And many additives are labeled as GRAS "Generally Recognized As Safe". This is a weak and meaningless label and should never be trusted.

Kudos to you for making your own bread :) However just be aware that unbleached flour is highly processed. Even whole wheat flour is typically pulverized and becomes too starchy and converts to sugar quickly in the body - ultimately storing fat. Using sprouted flour is healthier. It releases more nutrients; it's easier to digest; contains less gluten and has more protein. I also use Einkorn flour which is another healthier option. It's an ancient grain which has remain unchanged since inception - and not genetically modified like other wheat.

4 0 Reply • Share ›

**Jacek R**
17 days ago

Putting the current FDA in charge of our food and drugs, is like putting the Cub Scouts in charge of our food and drug decisions. Actually, we may be better off with the Cub Scouts.

5 0 Reply • Share ›

**Wendy**
16 days ago

I use only gluten free bread and I've never seen potassium bromate in any of them. Please note that wheat contains around 20 different types of gluten, including the common gliadin, and none of them are digestible by humans. Humans do not make the enzymes necessary to digest gluten. Whenever eaten, gluten causes damage to the digestive system lining, whether one feels any symptoms or not. Damage is being done. Sometimes the lining heals and sometimes it does not and celiac disease and other problems can result, including cancer. Another fact is that gluten causes far more antibodies to the brain than it does to anything else. Food for thought...

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**BChristine** → Wendy
14 days ago

Good information to know - thank you. The only gluten-free breads I see have way too many additives which I stay away from as much as I possibly can ... the additives alone can mess with your gut microbiome!

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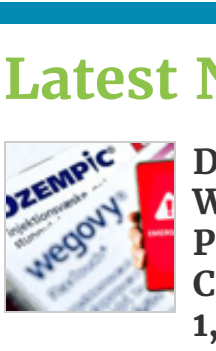
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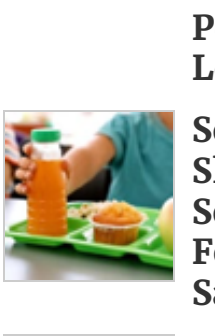
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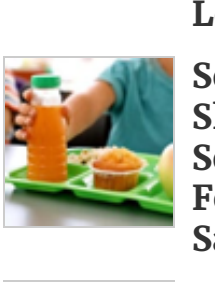
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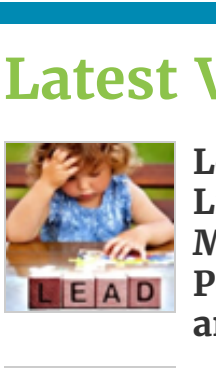
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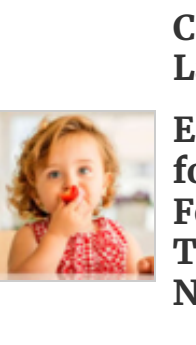
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